REMARKS

Claims 1-10 are all the claims pending in the application. Applicants thank the Examiner for indicating that although Claims 2, 3, 7 and 8 are objected to as being dependent upon a rejected base claim, they would be allowable if rewritten in independent form.

Claims 1 and 6 are rejected under 35 U.S.C. § 102(b) as being anticipated by Milner (4,862,152).

Claims 1, 4, 5, 6, 9 and 10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Katagiri et al. (2003/0001818) in view of Sasaki et al. (5,499,306).

Applicants kindly request the Examiner to reconsider and withdraw the prior art rejections in view of the following remarks.

I. Claim 1

A. Milner

Applicants respectfully submit that **Milner** fails to teach or suggest a control unit for producing a virtual handwriting plane in three-dimensional space having the shortest distances with respect to respective positions in predetermined time intervals based on three-dimensional track information obtained through tracking, and projecting the respective positions in the predetermined time intervals onto the virtual handwriting plane to recover the motions in space, wherein the virtual handwriting plane is produced virtually in three-dimensional space by being adaptive or based on the tracked position changes of the body of the system.

The claimed invention includes:

(1) a control unit producing a virtual handwriting plane in three-dimensional space based on three-dimensional track information obtained through tracking

(2) the control unit projecting the respective positions onto the virtual handwriting plane

(3) the virtual handwriting plane being produced in space by being adaptive or based on the tracked position changes of the body of the system.

Thus, the virtual plane is produced based on the tracked movements of the body, and then the positions are projected onto the virtual plane.

i. Control Unit Produces Virtual Plane

The Examiner considers the virtual plane to be produced by the receiver frame 110 (at 120, 130, 140) in Milner.

However, the so-called virtual handwriting plane is produced before a body makes any movements. That is, the so-called plane is fixed in place based on the position of the frame 110 before a body ever makes movements or track information is produced. Therefore, it is not possible that the so-called virtual handwriting plane could be based on three-dimensional track information obtained by tracking.

ii. Control Unit Projects Positions on the Plane

Milner does not project positions onto a virtual plane. As noted above, the plane is not a virtual handwriting plane as defined in the pending application. Rather, the positions are projected onto the fixed plane of the computer screen. This plane was fixed in place before movements were tracked or the object to be tracked began to move.

iii. Plane is Adaptive or Based on Position Changes

The so-called plane in Milner is not adaptive. It is fixed in one spot based on the computer screen position. It cannot change based on position changes of the body in the system that is being tracked.

While the virtual plane of the present invention is *produced by tracking movements*, the so-called plane in Milner *tracks the movements*. In other words, the handwriting plane of the present invention is not defined by a fixed element such as the receivers in Milner. The process for determining this virtual handwriting plane is one of the novel advantages to the present invention. Particularly, a user will write in mid-air but generally does not write in mid-air on a single flat plane. Thus, a virtual three dimensional plane must be generated based on the user's mid-air movements. The virtual plane is formed relative to the user's movement (i.e. handwriting tracks) and is not formed relative to a fixed receiver.

As noted in the specification, the virtual handwriting plane is in three dimensional space (page 8, paragraph [36], FIGS. 6-7, and page 10, paragraph [42]). Further, as discussed at paragraph [32], the process for determining a virtual handwriting plane is a process for determining a plane most adjacent to a set of respective points derived from handwriting tracks in three-dimensional space.

Unlike Milner in which the so-called plane is "utilized *to track* and capture position data of the transmitter" (see Examiner's Remarks at paragraph no. 7), the virtual plane of the present invention is *derived from* the tracked data. The virtual plane is created from the user's movement. It is not known where the virtual plane will be located until the user begins making motions in space.

This is a completely different concept from Milner in which the plane is prepared ahead of time, when the receivers are placed with the computer.

B. Combination of Katagiri and Sasaki

Katagiri does not teach or suggest a control unit for producing a virtual handwriting plane in three-dimensional space having the shortest distances with respect to respective positions in predetermined time intervals based on three-dimensional track information obtained through tracking, and projecting the respective positions in the predetermined time intervals onto the virtual handwriting plane to recover the motions in space, wherein the virtual handwriting plane is produced virtually in three-dimensional space by being adaptive or based on the tracked position changes of the body of the system.

The claimed invention includes:

(1) a control unit producing a virtual handwriting plane in three-dimensional space based on three-dimensional track information obtained through tracking

(2) the control unit projecting the respective positions onto the virtual handwriting plane

(3) the virtual handwriting plane being produced in space by being adaptive or based on the tracked position changes of the body of the system.

Thus, the virtual plane is produced based on the tracked movements of the body, and then the positions are projected onto the virtual plane.

i. Control Unit for Producing Virtual Plane

Katagiri does not disclose a control unit for producing a virtual handwriting plane based on tracked information. The plane is not produced in space by being adaptive or based on

tracked position changes. Rather, Katagiri discloses a **fixed** display means 160. This displays the user's input handwritten data, e.g. the user's signature. This display means 160 is not a virtual handwriting plane because a **plane** is not produced based on tracked information and it is not in three-dimensional space. Instead, it is provided in a fixed position before the user ever begins to write their name and this position of the display is unrelated to how the name is written.

Sasaki fails to make up for the deficiencies of Katagiri. There is no manner for producing a virtual handwriting plane. Sasaki is concerned with determining the position and attitude of a camera. The Office Action appears to rely on the least square estimation section 110 (see Office Action at page 5, first full paragraph) as producing a virtual plane. However, Sasaki suffers from similar drawbacks of Katagiri. There is no teaching or suggestion of a control unit for producing a virtual plane based on tracked movements.

ii. Control Unit for Projecting Positions onto Plane

Moreover, Katagiri does not project the respective positions onto a virtual handwriting plane. There is no manner for projecting positions into three-dimensional space. Instead, the handwriting is projected onto a fixed display surface based on pictures taken by cameras. This is completely different from the present invention which creates a virtual handwriting plane based on the tracked information so that the plane is adaptive and based on changes in position of the body, and projects positions onto the virtual plane.

Sasaki fails to make up for the deficiencies of Katagiri. There is no projecting of positions onto a virtual handwriting plane in three dimensional space.

iii. Plane is Adaptive or Based on Position Changes

The so-called plane in Katagiri is not adaptive. It is fixed in one spot based on the position of the display apparatus 160. It does not change based on position changes of the body in the system that is being tracked.

While the virtual plane of the present invention is *produced by tracking movements*, the so-called plane in Katagiri *tracks the movements*. In other words, the handwriting plane of the present invention is not defined by a fixed element such as the display 160 in Katagiri. The process for determining this virtual handwriting plane is one of the novel advantages to the present invention. Particularly, a user will write in mid-air but generally does not write in mid-air on a single flat plane. Thus, a virtual three dimensional plane must be generated based on the user's mid-air movements. The virtual plane is formed relative to the user's movement (i.e. handwriting tracks) and is not formed relative to a fixed receiver.

As noted in the specification, the virtual handwriting plane is in three dimensional space (page 8, paragraph [36], FIGS. 6-7, and page 10, paragraph [42]). Further, as discussed at paragraph [32], the process for determining a virtual handwriting plane is a process for determining a plane most adjacent to a set of respective points derived from handwriting tracks in three-dimensional space.

Unlike Katagiri in which the so-called plane is "utilized *to track* and capture position data of the transmitter" (see Examiner's Remarks at paragraph no. 7), the virtual plane of the present invention is *derived from* the tracked data. The virtual plane is created from the user's

movement. It is not known where the virtual plane will be located until the user begins making motions in space.

This is a completely different concept from Katagiri in which the plane is prepared ahead of time, when the receivers are placed with the computer.

Sasaki fails to make up for the deficiencies of Katagiri. Namely, this reference fails to use tracked position changes of a body of a system to produce a virtual plane, so that this plane is adaptive based on the movements rather than fixed in place.

II. Claim 6

A. Milner

Milner fails to teach or suggest producing a virtual handwriting plane in three-dimensional space having the shortest distances with respect to respective positions in predetermined time intervals onto the virtual handwriting plane and recovering the motions in space, wherein the virtual handwriting plane is determined by being adaptive or based on the tracked position changes of the body of the system.

The claimed invention includes the steps of:

(1) producing a virtual handwriting plane in three-dimensional space based on three-dimensional track information obtained through tracking

(2) projecting the respective positions onto the virtual handwriting plane

(3) the virtual handwriting plane being produced in space by being adaptive or based on the tracked position changes of the body of the system.

Thus, the virtual plane is produced based on the tracked movements of the body, and then the positions are projected onto the virtual plane.

This step of producing a virtual plane based on the movements of the body, before any positions are projected onto the virtual plane, is completely missing from Milner.

i. Producing a Virtual Plane

Specifically, the so-called virtual handwriting plane in Milner is produced **before** a body makes any movements. The so-called plane is fixed in place based on the position of the frame 110, and is not based on the movements of the body; the frame (plane) is produced before a body ever makes movements or track information is produced. Therefore, it is not possible that the so-called virtual handwriting plane could be based on three-dimensional track information obtained by tracking.

ii. Projecting Positions on the Virtual Plane

Milner does not project positions onto a virtual plane. As noted above, the plane is not a virtual handwriting plane as defined in the pending application. Rather, the positions are projected onto the fixed plane of the computer screen. This plane was fixed in place before movements were tracked or the object to be tracked began to move.

iii. Plane is Adaptive or Based on Position Changes

The so-called plane in Milner is not adaptive. It is fixed in one spot based on the computer screen position. It cannot change based on position changes of the body in the system that is being tracked.

While the virtual plane of the present invention is *produced by tracking the movements*, the so-called plane in Milner *tracks the movements*. In other words, the handwriting plane of the

present invention is not defined by a fixed element such as the receivers in Milner. The process for determining this virtual handwriting plane is one of the novel advantages to the present invention. Particularly, a user will write in mid-air but generally does not write in mid-air on a single flat plane. Thus, a virtual three dimensional plane must be generated based on the user's mid-air movements. The virtual plane is formed relative to the user's movement (i.e. handwriting tracks) and is not formed relative to a fixed receiver.

As noted in the specification, the virtual handwriting plane is in three dimensional space (page 8, paragraph [36], FIGS. 6-7, and page 10, paragraph [42]). Further, as discussed at paragraph [32], the process for determining a virtual handwriting plane is a process for determining a plane most adjacent to a set of respective points derived from handwriting tracks in three-dimensional space.

Unlike Milner in which the so-called plane is "utilized *to track* and capture position data of the transmitter" (see Examiner's Remarks at paragraph no. 7), the virtual plane of the present invention is *derived from* the tracked data. The virtual plane is created from the user's movement. It is not known where the virtual plane will be located until the user begins making motions in space.

This is a completely different concept from Milner in which the plane is prepared ahead of time, when the receivers are placed with the computer.

B. Combination of Katagiri and Sasaki

Katagiri does not teach or suggest producing a virtual handwriting plane virtually in three-dimensional space having the shortest distances with respect to respective positions in

predetermined time intervals based on three-dimensional track information obtained through tracking, and projecting the respective positions in the predetermined time intervals onto the virtual handwriting plane and recovering the motions in space, wherein the virtual handwriting plane is determined by being adaptive or based on the tracked position changes of the body of the system.

The claimed invention includes the steps of:

(1) producing a virtual handwriting plane in three-dimensional space based on three-dimensional track information obtained through tracking

(2) projecting the respective positions onto the virtual handwriting plane

(3) the virtual handwriting plane being produced in space by being adaptive or based on the tracked position changes of the body of the system.

Thus, the virtual plane is produced based on the tracked movements of the body, and then the positions are projected onto the virtual plane.

i. Producing a Virtual Handwriting Plane

Katagiri does not disclose a step of **producing a virtual handwriting plane** based on tracked information. A handwriting plane is not produced virtually in three dimensional space. Rather, Katagiri discloses a **fixed** display means 160. This displays the user's input handwritten data, e.g. the user's signature. This display means 160 is not equivalent to the claimed virtual handwriting plane because it is not produced based on tracked information and it is not in three-dimensional space based on the body position. Instead, it is provided in a fixed position before the user ever begins to write their name and this position of the display is unrelated to how or where the name is written in space.

Sasaki fails to make up for the deficiencies of Katagiri. Sasaki is concerned with determining the position and attitude of a camera. There is no teaching or suggestion of producing a **virtual handwriting plane.** The Office Action appears to rely on the least square estimation section 110 for this feature. However, Sasaki is not concerned with producing handwriting planes. Sasaki is silent regarding the interpretation of a handwriting movement in mid-air. This reference suffers from similar drawbacks of Katagiri. There is no teaching or suggestion of producing a virtual plane based on tracked movements of a body in a system, so that the handwriting plane is produced virtually in space.

ii. Projecting Positions onto a Virtual Plane

Moreover, Katagiri does not project respective positions onto a virtual handwriting plane. There is no manner for projecting positions into three-dimensional space. Instead, the handwriting is projected onto a fixed display surface based on pictures taken by cameras. This is completely different from the present invention which creates a virtual handwriting plane based on the tracked information and projects the positions of the handwriting onto the virtual plane that has been created in the earlier step.

Sasaki fails to make up for the deficiencies of Katagiri. There is no projecting of positions onto a virtual handwriting plane in three dimensional space. This reference is silent with respect to this feature. This reference is not directed to handwriting in mid-air. This references provides no motivation for one of ordinary skill in the art to modify Katagiri to include this step projecting positions onto a virtual handwriting plane.

iii. Plane is Adaptive or Based on Position Changes

The so-called plane in Katagiri is not adaptive. It is fixed in one spot based on the position of the display apparatus 160. It does not change based on position changes of the body in the system that is being tracked.

While the virtual plane of the present invention is *produced by tracking movements*, the so-called plane in Katagiri *tracks the movements*. In other words, the handwriting plane of the present invention is not defined by a fixed element such as the display 160 in Katagiri. The process for determining this virtual handwriting plane is one of the novel advantages to the present invention. Particularly, a user will write in mid-air but generally does not write in mid-air on a single flat plane. Thus, a virtual three dimensional plane must be generated based on the user's mid-air movements. The virtual plane is formed relative to the user's movement (i.e. handwriting tracks) and is not formed relative to a fixed receiver.

As noted in the specification, the virtual handwriting plane is in three dimensional space (page 8, paragraph [36], FIGS. 6-7, and page 10, paragraph [42]). Further, as discussed at paragraph [32], the process for determining a virtual handwriting plane is a process for determining a plane most adjacent to a set of respective points derived from handwriting tracks in three-dimensional space.

Unlike Katagiri in which the so-called plane is "utilized *to track* and capture position data of the transmitter" (see Examiner's Remarks at paragraph no. 7), the virtual plane of the present invention is *derived from* the tracked data. The virtual plane is created from the user's movement. It is not known where the virtual plane will be located until the user begins making motions in space.

This is a completely different concept from Katagiri, which provides the plane before any handwriting motions take place.

Sasaki fails to make up for the deficiencies of Katagiri. Namely, this reference fails to use tracked position changes of a body of a system to produce a virtual handwriting plane, so that this plane is adaptive based on the movements rather than fixed in place.

III. Dependent Claims 4-5, 9-10

The remaining rejections are directed to the dependent claims. These claims should be patentable for at least the same reasons as claims 1 and 6 by virtue of their dependency therefrom.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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Date: December 19, 2008